Saskatchewan
Agriculture

Bright Sand Forage Project

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The information in this pamphlet was made possible by the farmer members of the Bright Sand Forage Project:

John Brown, Bright Sand
Peter Schmidt, St. Walburg
Gerald Gervais, Bright Sand
Fred Woidyla, St. Walburg
Wilfred Hamm, Livelong
Harold Kivimaa, Livelong

In co-operation with N.W. Regional Staff of Saskatchewan Agriculture:

Valerie Matschke Muller, Ag Rep
David Jensen, Land Rep
Lyle Darwent, Farm Management Specialist
Bob Sparling, Livestock Specialist
Terry Wakelin, Soils and Crops Specialist

Soil and climate

The Bright Sand Forage Project is located eighteen miles north of St. Walburg. It is in an area referred to as the Forest Fringe. The soil is classified as a Waitville soil. This is a grey-wooded soil developed under trees in a cool sub-humid climate. The growing season is generally short with better than average rainfall.

The soils are grey in color, low in organic matter, nitrogen, phosphorus and sulphur. They are difficult to keep in good tilth. Water infiltration is poor. Therefore, they tend to puddle when it rains and then bake hard as it dries. Cereal crops are often damaged by frost because of the short growing season. Significant areas of these marginal soils are found along the northern parts of the Saskatchewan agricultural area.

Forage varieties used on the project

Grimm alfalfa is an older tap-rooted variety which was used in the area. When compared to newer varieties such as Beaver and Rambler, Grimm had more winter kill.

Rambler and Drylander alfalfa are creeping rooted varieties which are widely used. They are very hardy and drought tolerant.

From the beginning of the project different forage varieties have been tried.

Beaver alfalfa is a branch-rooted variety recommended in areas with above average moisture. It is hardy and regrows moderately quickly after cutting. This variety appears to respond to wider row spacings.

Anchor alfalfa is a new variety which regrows quickly after cutting. It is less hardy than Beaver or Rambler. So far, it has survived well on the project.

Altai wild rye grass has potential for late fall and winter pasture. However, it did not establish or grow well on the project.

Russian wild rye grass is very palatable with good nutrient value in all stages of growth. This grass established, but the plants were weak and not productive on the grey-wooded soils. It responded to fertilizer.

Intermediate wheatgrass was chosen as an alternative to bromegrass. It appeared to be very competitive reducing the alfalfa part of the mixture to an insignificant portion of the stand. The overall stand appeared poor.

Bromegrass and alfalfa are the standard forages used in this area for hay and pasture. Crested wheatgrass and alfalfa was chosen because this combination has not been widely used in the north. In the project it has produced a comparable tonnage of forage to brome and alfalfa.

Timothy and alfalfa were chosen as an alternative to brome and alfalfa for hay. This combination can be used where moisture is plentiful. It has produced comparable tonnage to brome and alfalfa in the project. A number of smaller plots have been seeded for demonstration purposes, such as rough fescue, orchard grass, meadow brome and smooth brome.

Rough fescue is a native grass. This grass did not establish well.

Orchard grass is very digestible, palatable forage. It is not hardy in the area. It winter killed in the open areas, but has survived close to the bush where there is protection.

Meadow bromegrass is similar in appearance to smooth bromegrass, but is a cool season grass which does not become root bound. It appears to be hardy.

The Committee plans to add a number of additional grasses for visual observation.

Forage Nutritional Value

A well managed hay crop can provide a more than adequate diet for wintering beef cows and almost enough nutrients for wintering weaned calves. On the other hand, mismanagement of a hay crop can reduce its feeding value to little more than that of straw.

When forages are in a lush, vegetative state, they contain a lot of water. However, on a dry matter basis, they are also rich in protein, energy, minerals, and vitamins. Dairy and beef cows will milk well on lush grass. Yearling slaughter cattle can finish in the A grade on good pasture. Unfortunately, as forage crops ripen, the proportion of protein, carbohydrates, minerals and vitamins decreases and the percentage of fiber increases.

As the fiber content increases, the intake capacity of animals decreases. The net effect of low nutrients in the forage and low intake is poor animal performance.

Table I contains the requirement levels of some of the most important nutrients for pregnant beef cows, lactating beef cows, and for growing weaned calves.

The feed analysis carried out in 1984 are grouped into two categories, grass-alfalfa and alfalfa, and averaged in Table II. Both types of hay are very deficient in phosphorus, copper, and zinc for all classes of beef cattle, dairy cattle, and horses. These deficiencies can be corrected by feeding adequate levels of a 1:1 mineral which is high in trace minerals.

The grass-alfalfa hay is marginally adequate in protein for pregnant cows. For lactating cows and weaned calves, it should be supplemented with grain and a protein supplement in addition to a mineral mix and Vitamin A.

The pure alfalfa hay needs to be supplemented with grain, in addition to a mineral mix and Vitamin A to provide a balanced ration for lactating beef cows and weaned calves.

Protein in the ration is used mainly to repair and build muscle and organ tissue. TDN provides heat and energy for animals to grow and move about. Phosphorus has important functions in metabolism, fertility and bone growth. Trace minerals play an important role in many body functions involving the blood, organ tissue, bone and hormone development. Although trace minerals are only needed in small amounts, they are very important to the health and productivity of cattle. Unfortunately, many forage crops are severely deficient in several trace elements. These deficiencies cause a wide variety of problems in livestock which are not clearly understood.

Comparing the nutrient needs of animals to the nutrient contents of forages demonstrates that some forages are better suited to certain classes of cattle than others. The price of forage should closely follow its nutrient content. The higher the nutrient content in hay the less need there is for commercial supplements to balance rations.

TABLE I

NUTRIENT REQUIREMENTS OF BEEF ANIMALS

Nutrients	Pregnant Cows	Lactating Cows	Weaned Calves
Crude Protein	7.5%	10%	10 - 12%
TDN	48 - 50%	55 - 57%	56 - 60%
Calcium	.35%	.40%	.5%
Phosphorus	.3%	.35%	.35%
Copper	10 ppm	10 ppm	10 ppm
Zinc	40 ppm	40 ppm	40 ppm
Manganese	50 ppm	50 ppm	50 ppm
Selenium	.1 - .2 ppm	.1 - .2 ppm	.1 - .2 ppm

1985 Hay Analysis

TABLE II

	Grass Alfalfa Hay Av of 15 Samples	Alfalfa Hay Av of 4 Samples
Average Moisture Content	10%	10%
Average Crude Protein	6%	10.8%
Average TDN	54%	51%
Average Calcium	.57%	1.35%
Average Phosphorus	.12%	.15%
Average Copper	3 ppm	5 ppm
Average Zinc	15 ppm	23 ppm
Average Manganese	36 ppm	31 ppm
Average Selenium	.19 ppm	.33 ppm

Partial Economic Analysis of the Bright Sand Forage Project 1984

The objective of the economic analysis was to compare the gross return per acre of the various forage plots and the return per dollar invested in fertilizer at two different fertilizing rates. The high rate was the rate recommended by the Soil Test Laboratory and the low rate was 60% of the recommended rate. The forage plots were established in 1979, but no yield data was available until 1982 on the grass-alfalfa mixtures and 1983 on the alfalfa only plots.

Different varieties and different rates of fertilizer mean a variation in yield as shown in the assorted lengths of stacks.

The analysis of fertilizer responses should be viewed with some caution for the following reasons.

1. The cost of applying fertilizer has not been included.
2. There would be a greater cost to harvesting larger volumes, but no harvesting costs were included.
3. Simple averages were used for yield returns and fertilizer costs. In 1984 all forage plots were individually feed tested and valued on a nutrient basis compared to barely, canola, and mineral at the fall of 1984 values. The values based on nutrients are available, but are not included in this report. Forage returns used are what the project sold the hay for, after harvesting each year.
4. Weeds, in particular quack grass, have been a problem. Some plots were worked up because of quack grass and quack grass has, no doubt, had some effect on the plots included in this analysis.

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1982, 1983, 1984 (3 YEAR AVERAGE)

Average Yield		Ave Market Value	Less Fert Cost	*Ave Return Above Fert Cost	**Return Per Dollar of Fert Investment
Intermediate Wheat Grass & Alfalfa					
- Control	2319	84.16	--	84.16	--
- Low Rate	2985	108.67	21.19	87.48	1.16
- High Rate	3115	112.60	29.09	83.51	.98
Brome & Alfalfa 6"					
- Control	2271	82.15	--	82.15	--
- Low Rate	3236	117.94	21.19	96.75	1.69
- High Rate	4124	149.46	29.09	120.37	2.31
Brome & Alfalfa 12"					
- Control	1955	71.04	--	71.04	--
- Low Rate	2851	104.39	21.19	83.20	1.57
- High Rate	3517	126.82	29.09	97.73	1.92
Crested Wheat Grass & Alfalfa					
- Control	2271	82.27	--	82.27	--
- Low Rate	3166	116.01	21.19	94.82	1.59
- High Rate	3470	125.98	29.09	96.89	1.50
Timothy & Alfalfa					
- Control	2381	86.84	--	86.84	--
- Low Rate	3139	114.66	20.70	93.96	1.34
- High Rate	4132	150.00	25.38	124.62	2.49
1983, 1984 (2 YEAR AVERAGE)					
Drylander Alfalfa					
- Control	3933	173.05	--	173.05	--
- Low Rate	4248	186.89	23.44	163.45	.59
- High Rate	4543	199.89	22.77	177.12	1.18
Anchor Alfalfa					
- Control	3508	154.35	--	154.35	--
- Low Rate	3811	167.67	23.44	144.23	.56
- High Rate	4098	180.31	22.77	157.54	1.14

* The average return above fertilizer cost is determined by subtracting the average cost of fertilizer per acre from the average value of forage produced on an acre.

** The average return per dollar of fertilizer investment is determined by dividing the average increase in value of forage produced at the high or low fertilizing rate (compared to the control plot) by the average cost of fertilizer applied on that plot.

Fertilizing Forage Crops

There are many things to consider when fertilizing forages.

The fertilizer to use.
The rate to apply.
When to apply - fall vs spring?
Legume vs grasses?
Cost, does it pay?

Different crops require different amounts of nutrients. The following table shows the different amounts of nutrients required to grow a crop expressed in lbs./acre

TABLE I

	Nitrogen (N)	Phosphorus (P)	Potassium (K)	Sulphur (S)
Grass				
3 tons/acre	110	30	144	9
Alfalfa				
4 tons/acre	239	40	190	20

If one of these nutrients is limited, then the yield is reduced even though the other nutrients are in adequate supply. Therefore, soil testing becomes very important to make the right management decision of what to apply and how much.

An example of soil test results is shown in Table II. This test was taken from the Bright Sand Project in late fall of 1983.
The available N per acre was 8 lbs./acre

TABLE II

Bright Sand Project

Nitrogen (N)	Phosphorus (P)	Potassium (K)	Sulphur (S)
	lbs./acre of Nutrient		
8	11	160	29

As a consequence of the low soil test N level, the nitrogen fertilizer recommendation would be high remembering that 110 lbs. of N is required to produce 3 tons of grass per acre. Don't go by these levels for your farm because there are tremendous differences from field to field and year to year. Table III shows the fertilizer recommendation in lbs./acre of each of the main nutrients, for this Bright Sand Project.

TABLE III

Recommendations in lbs./acre

	N	P	K	S
Grass-Legume	30	50	60	20
Grass	90	50	50	10

If we look at the nitrogen fertilizer recommendation for the grass, the recommendation was 90 lbs./acre. Table I indicates that 110 lbs. is required to grow 3 tons/acre. The soil test shows 8 lbs. of N available per acre in the soil. One can assume that the remaining requirements for N will be released from the soil in addition during the growing season. The following then indicates why the 90 lbs. was recommended:

Available Soil Nitrogen (N)	8 lbs/acre
Soil Nitrogen Release	12 lbs/acre
Fertilizer Recommendation	90 lbs/acre
Total Requirement	110 lbs/acre

Why was there a marked difference between the 30 lb. nitrogen recommendation for the alfalfa grass mixture compared to a 90 lb. nitrogen recommendation for the grass? When properly inoculated, legumes use nitrogen from the air, hence, they do not require nitrogen fertilizer. Even though alfalfa uses more nitrogen than a grass crop (Table I), the fixation of nitrogen eliminates the need for the application of large amounts of N fertilizer. The 30 lb. recommendation for the grass-legume suggests that the alfalfa is supplying its own N needs plus some of the grass's, but not all of it.

Newer stands of alfalfa will fix more nitrogen than older stands. One should dig up legume plants and examine the roots for the nitrogen fixing nodules. The nodules when cut open should be pink in color. The pink color indicates nitrogen fixation is occurring.

Proper fertilizer management is very important for good forage yields.

One should note from Table III that there is a higher requirement for sulphur for the grass-legume compared to the grass. Remember from Table I that alfalfa requires twice as much sulphur as a grass crop, hence, the higher recommendation. Grey-wooded soils are usually low in sulphur, thus show the most rapid and dramatic yield response to sulphur and nitrogen. Remember, nitrogen and sulphur are water soluble. Phosphorus and potassium do not move as readily in the soil. Residual responses to surface applied phosphorus are common for two or three years. It is recommended that the phosphorus be applied before the seeding of the forage. It also helps if the phosphorus is banded to obtain the best efficiency of the phosphate fertilizer. Higher applications of phosphate can be done this way to avoid problems such as seedling damage caused by too heavy a rate of fertilizer applied with the seed.

Grasses show the quickest and the greatest response to nitrogen fertilizer. Legumes will show a response to nitrogen if the stand is old and not readily fixing its own nitrogen. Remember the importance of sulphur for a legume. Phosphorus and potassium responses will not likely be dramatic but these elements are important and should be provided as per the soil test recommendation.

When a grass-legume mixture is grown, it is difficult to apply fertilizer to supply the ideal combination of grasses and legumes. For example, following a nitrogen application to a bromegrass-alfalfa crop - the productivity of bromegrass will increase at the expense of the alfalfa. In most cases, best results are obtained by applying a nitrogen phosphate blend to grass legume mixture. If alfalfa is grown on a grey-wooded soil, sulphur in the blend would likely be an additional benefit.

Time of fertilizer application is important depending on several factors such as the variability of spring rains, spring flooding, etc. Late fall application should be considered where spring rainfall is variable. Do not fall apply if there is going to be excessive run-off or spring flooding. A spring application when the soil is just dry enough to support field equipment is suggested under these conditions. Timing of fertilizer application is determined by such things as: topography, soil type, spring flooding and spring rainfall.

Forage Establishment

Weed control has been the biggest problem in the Bright Sand Forage Project. The major weed problem is quack grass.

Other weeds such as hawk's beard, corn spurry and rough cinquefoil, to name just a few, are also problem weeds. Glyphosate (Roundup) has been used to control quack grass on a re-establishment area. This was done in the fall of 1984. In the spring of 1985 Trifluralin (Treflan) was used for weed control. The forage to be planted is different varieties of alfalfa in various row spacings.

To establish and maintain a good forage stand the following practices should be considered:

- Sow early in the spring or late fall, just before freeze up.

- A firm seedbed is very important. Seeding depth is dependent on a firm seedbed. The seeding depth should be 1/4 to 1/2 inch for small seeds and no greater than 1 inch for large seeds.

- The seeding rate should be 25 - 30 seeds per foot of row. To obtain the seeding rates per acre for different forages check the current Forage Crop Recommendations published by Saskatchewan Agriculture.

- The seedbed should be as weed free as possible; particularly free of quack grass and other persistent perennials.

- Twelve - 18 inch row spacings in the higher rainfall areas give superior yields with lower seed costs per acre.

- Seed of Certified status will ensure genetic trueness of variety. Select a variety that has been proven to do well under your soil and climatic conditions.

- There are no herbicides that can be used on grass-legume mixtures. If the forages are seeded alone there are herbicides that can be used. Check the current edition of Chemical Weed Control in Cereal, Oilseed, Pulse and Forage Crops, published by Saskatchewan Agriculture.